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THE ORIGINAL DISTINCTION OF THE TESTICLE AND OVARY.* — An interesting contribution to the germ layer or Gastræa theory of Haeckel, which is now exciting the attention of embryologists and evolutionists, is afforded by Prof. E. Van Beneden of Liége. It will cause an inquiry into the real value of Haeckel's Gastræa theory, disputed by some of our leading zoologists. We translate Van Beneden's introduction and conclusions.

"Huxley was the first who demonstrated that the entire organization of the zoophytes, medusæ, and polypes, hydroids and Siphonophores can be reduced to a sac formed of two adjacent cellular layers, the ectoderm and entoderm (Allman), and who considered this proposition as expressing the general law of structure in the zoophytes.† Although one did not dream at this period of seeking homologies between the vertebrates and lower animals, Huxley took in all the bearings of his discovery. He recognized and formulated in clear and precise language his opinion on the homology which he believed exists between the ectoderm and entoderm of the Cœlenterata, and the two primordial cellular layers of vertebrates. See in what terms he expresses this idea; 'the peculiarity in the structure of the body-walls of the Hydrozoa, to which I have just referred, possesses a singular interest in its bearings upon the truth that there is a certain similarity between the adult states of the lower animals and the embryonic conditions of higher organizations.

'For it is well known that, in a very early state, the germ, even of the highest animals, is a more or less complete sac, whose thin wall is divisible into two membranes, an inner and an outer; the latter, turned toward the external world; the former, in relation with the nutritive liquid, the yolk. . . . . The various organs are produced by a process of budding from one, or other, or both of these primary layers of the germ.'

He seeks likewise to establish a parallelism, from a histological point of view between the ectoderm of zoophytes and the external layer of the embryo of vertebrates on one hand, and the endoderm and internal layer on the other. He concludes by saying: 'thus there is a very real and genuine analogy between the adult Hydrozoon and the embryonic vertebrate animal.' All the embryological researches made in late years, in the first phases of the embryonic development of animals of all branches, have tended to confirm, extending it to the whole animal kingdom, the opinion of the illustrious English naturalist. And in the first rank of work done in this direction may, without fear of contradiction, be cited that of Kowalevsky; in showing the identity of development of Amphioxus and of the Ascidians, he closed with a single stroke the abyss, thought to be impassable, which separates the branch of vertebrates from all the lower organisms. The important publications of the same author on the other types of organization, added to those of Gegenbaur, Haeckel, Ray Lankester, Kleinenberg and some others, have resulted in extending to the entire animal kingdom this grand conception that all the parts of the animal organism are formed from the two primordial cellular layers, and everywhere homologous.

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* De la Distinction originelle du Testicule et de l'Ovaire; Caractère sexuel des deux Feuillets primordiaux de l'Embryon; Hermaphrodisme morphologique de toute Individualité animale; Essai d'une Théorie de la Fécondation. Bruxelles, 1874. 8vo, pp. 68.

† Observations upon the Anatomy of the Diphydæ and the Unity of Organization of the Diphydæ and Siphonophoræ. Proceedings Royal Society, 1849.

These ideas have just been developed in detail and brilliantly defended in two essays of a high philosophic import. Haeckel has proposed in his brochure *Die Gastrœa theorie*, *die phylogenetische Classification des Thierreiches und die Homologie der Keimblätter*, a theory which he had first announced in his monograph on the calcareous sponges. Some analogous ideas, and in several respects almost identical, have been published in England in the Annals and Magazine of Natural History, under the title; "On the Primitive Cell-layers of the Embryo as the Basis of the Genealogical Classification of Animals" by my friend E. Ray Lankester.

All the pluricellular animals, in which the development begins by the segmentation of the cell-egg, pass through in the course of their evolution a similar embryonic form, that of a sac whose thin walls are constituted of two adjacent layers; the endoderm and ectoderm. The first surrounds a cavity which is the primordial digestive tube; the second limits exteriorly the body of the embryo; it alone can be impressed by external causes. The digestive cavity communicates with the exterior by a single orifice which serves both as mouth and anus. The embryo is reduced to a digestive cavity, which is but a simple stomach; Haeckel has proposed to give to this primordial form the name of *Gastrula.* As this embryonic form occurs in the vertebrates, as well as the mollusks, arthropods, echinoderms, worms and polypes, it is clear that the ectoderm is homologous in the different types of organization; that the endoderm has in all the same morphological value; that the primordial digestive cavity of vertebrates, and that of all other types of organization have the same anatomical signification. The existence of this common form in the course of evolution of all the metazoal animals allows us to refer them to a common source; there is a convergence of the great types of organization and not a parallelism as had been urged by Cuvier and Von Baer. Finally, we can infer the existence at a geological epoch far back, of organisms like the Gastrula form; these organisms, probably varied in a thousand ways in their form and in their external characters, have been the common source of vertebrates, arthropods, mollusks, echinoderms, worms and zoophytes; they constitute the very numerous group of Gastræades (Haeckel).

If the endoderm and ectoderm are homologous in all the Metazoa [*i.e.* all animals except Protozoa] we then have a right to suppose that these two cellular layers have in all the same histological value, and that the same systems of organs are developed in the different types of organization from the same primitive layers. This induction has been already freely confirmed in that which concerns the central nervous system, which is developed in all animals from the ectoderm.

Consequently, it makes no difference if we should wish to know the origin of an organ, whether we seek for it in one or another type of organization; the results can be extended to the whole animal kingdom, and receive a general signification.

However, of all the types of organization, that which serves best for research on this capital question of the origin of organic systems, is that of the polypes, still called zoophytes or Cœlenterates. In them, in short, the ectoderm and endoderm persist with their embryonic characters during their entire life; all the organs of the zoophytes are only a dependence of one or the other of these layers, sometimes of the two layers united.

The polype form may be traced back with the greatest facility to the Gastrula, all the parts of which are preserved without undergoing any great modifications during all the course of existence.

Conclusions. In the Hydractiniæ 1. The eggs are developed exclusively from the epithelial cellules of the endoderm. They remain, up to the time of their maturity, surrounded by the elements of the endoderm.

2. The testicles and spermatozoa are developed from the ectoderm; this organ results from the progressive transformation of a primitive cellular fold formed by invagination.

3. There exists in the female sporosacs a rudiment of the testicular organ; in the male sporosacs a rudiment of an ovary. The sporosacs are then morphologically hermaphrodites. * * * * Fecundation consists in the union of an egg, a product of the endoderm, with a certain number of spermatozoa, products of the ectoderm. This act has no other end than to unite chemical elements of opposite polarity, which, after having been united an instant in the egg, separate again; for in most animals those in which the division of the vitellus into two occurs, the elements from which the ectoderm are formed are already separated from those which are to form the internal layer of the embryo.

The new individuality is realized at the instant when the union between the elements of opposed polarity has taken place, as absolutely as a molecule of water is formed by the union of atoms of hydrogen and oxygen."

In a late paper on the embryology of jelly fishes Metznikoff has criticised the universal application of Haeckel's Gastræa theory, and shown that in the embryos of the Acalephs and Echinoderms the *outer* layer is invaginated and forms the walls of the stomach. And it appears to us that if organs, such as the ovary and testicle, almost universally recognized as homologous, are developed from opposite germ-layers, then the importance of the germ-layer theory of Haeckel is diminished by Van Beneden's remarkable discovery. We should say, however, that at the last meeting of the French Association for the Advancement of Science, Mr. P. Hallez questioned whether the ovary and testis were homologous. Meanwhile Giard announced at the same meeting that the male organs of *Sacculina*, a crustacean, are developed from the frontal glands, which in turn arise from the ectoderm.

MAPS OF WHEELER'S EXPEDITION.—We have received six advance sheets of a "Topographical Atlas" projected to illustrate Explorations and Surveys west of the 100th meridian of longitude, embracing results of the different expeditions under Lt. Wheeler, Corps of Engineers, U. S. A., published by the war department. The scale of each atlas sheet is one inch to eight miles. Sheet 50 covers portions of central and western Utah; sheets 58 and 59 embrace parts of eastern and southeastern Nevada and southwestern Utah; sheet 66 covers portions of southwestern Utah, northwestern Arizona and southeastern California. The work appears to be well done and will be useful to geographers and naturalists studying the distribution of plants and animals, especially the map of the areas of drainage to the Atlantic and Pacific oceans and of the interior basins of the United States, west of the Mississippi river.

We have found exceedingly useful the progress map of lines and areas lying west of the 100th meridian, and giving the lines of exploration by different parties sent out by government since Lt. Pike's expedition of 1805; not, however, including the area surveyed by parties under the Department of the Interior and Smithsonian Institution.

A large number of sheets are in preparation, and we shall ere long with the aid of these and the maps publishing by Hayden and Powell's expedition, with those of Whitney's Survey of California, be in possession of definite knowledge of the region west of the Mississippi, which is now altogether wanting in any atlas we have yet seen.